Malaria Prevention

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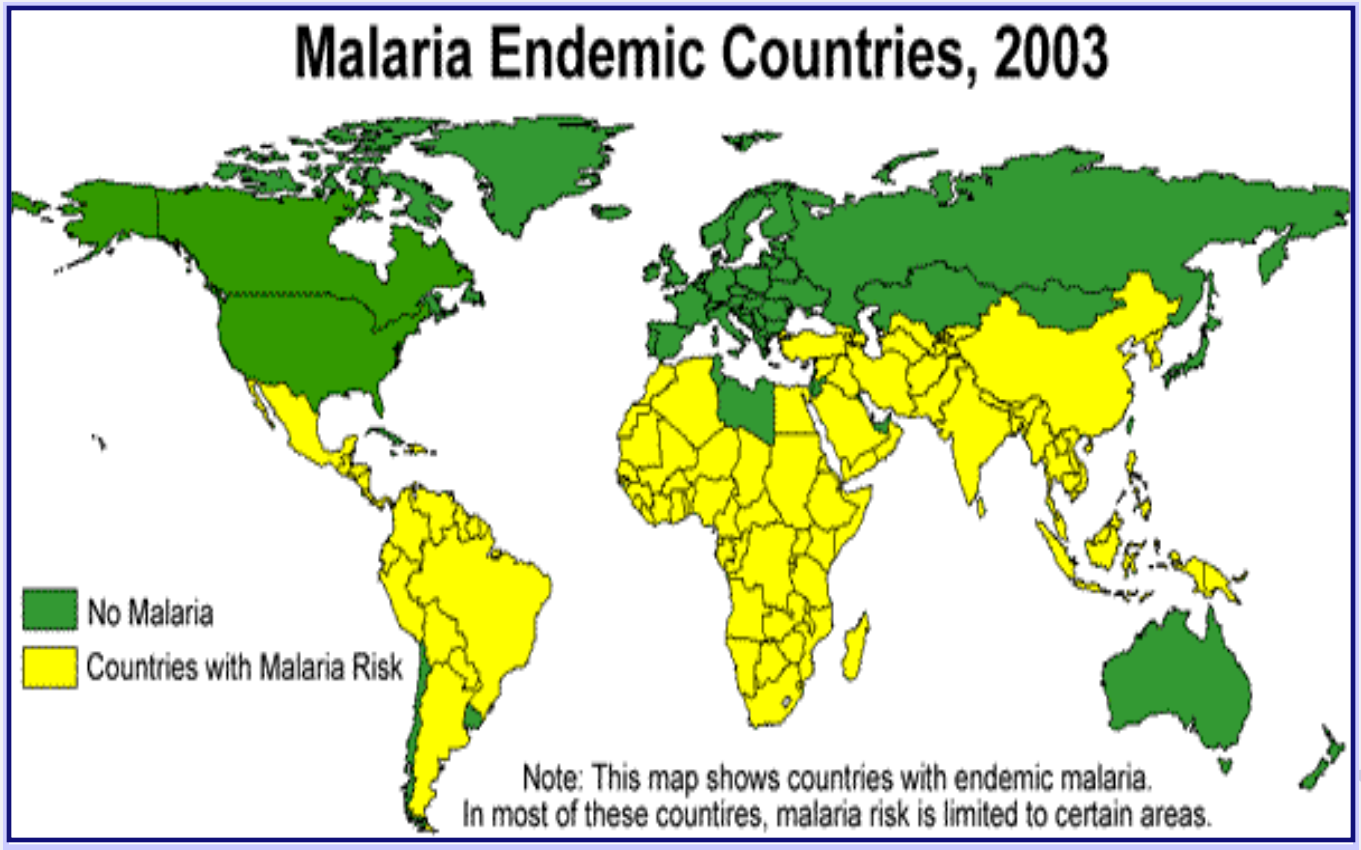
Malaria Prevention
Objectives

- ★ Describe geographic distribution and risk factors for malaria
- ★ Review classification and life cycle of malaria parasite
- ★ Describe personal protective measures for malaria prevention
- ★ Discuss malaria chemoprophylaxis

Epidemiology of Malaria

- Global malaria
  - Incidence increased over 40 years
  - 300-500 million infected annually (90% in Sub-Saharan Africa)
  - Over 1 million deaths annually (mostly infants and children)
- Reasons malaria problem has worsened
  - Development of resistance by parasite and mosquito vector
  - Socioeconomic problems
  - Movement of nonimmune populations into malarious areas (refugees and travelers)

Malaria Endemic Countries



Centers for Disease Control and Prevention

P. falciparum (most prevalent) and *P. malariae* in all shaded areas

P.ovale predominant in Sub-Saharan Africa and *P. vivax* in the other areas

Countries and Territories With Malarious Areas

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Afghanistan	French Guiana	Oman
Algeria*	Gabon	Pakistan
Angola	Gambia	Panama
Argentina*	Georgia*	Papua New Guinea
Armenia*	Ghana	Paraguay
Azerbaijan*	Guatemala	Peru
Bangladesh	Guinea	Philippines
Belize	Guinea-Bissau	Rwanda
Benin	Guyana	Sao Tome and Principe
Bhutan	Haiti	Saudi Arabia
Bolivia	Honduras	Senegal
Botswana	India	Sierra Leone
Brazil	Indonesia	Solomon Islands
Burkina Faso	Iran, Islamic Republic of	Somalia
Burundi	Iraq*	South Africa
Cambodia	Kenya	Sri Lanka
Cameroon	Korea, Democratic People's Republic of*	Sudan
Cape Verde	Korea, Republic of*	Suriname
Central African Republic	Kyrgyzstan	Swaziland
Chad	Lao People's Democratic Republic	Syrian Arab Republic*
China	Liberia	Tajikistan
Colombia	Madagascar	Tanzania, United Republic of
Comoros	Malawi	Thailand
Congo	Malaysia	Timor-Leste
Congo, Democratic Republic of the (former Zaire)	Mali	Togo
Costa Rica	Mauritania	Turkey*
Côte d'Ivoire	Mauritius*	Turkmenistan*
Djibouti	Mayotte	Uganda
Dominican Republic	Mexico	Vanuatu
East Timor	Morocco*	Venezuela
Ecuador	Mozambique	Viet Nam
Egypt	Myanmar	Yemen
El Salvador	Namibia	Zambia
Equatorial Guinea	Nepal	Zimbabwe
Eritrea	Nicaragua	
Ethiopia	Niger	
	Nigeria	

* = *P. vivax* risk only

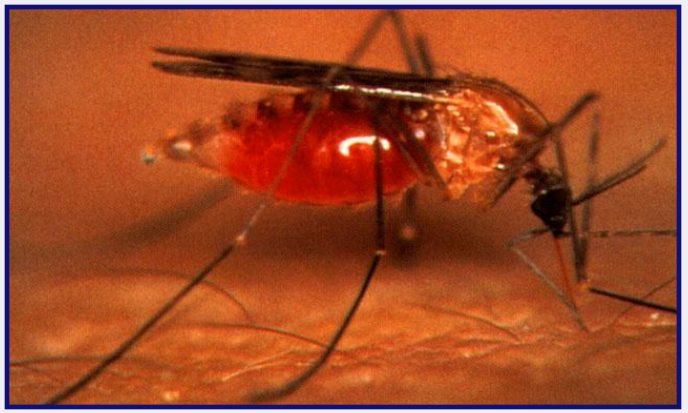
World Health Organization

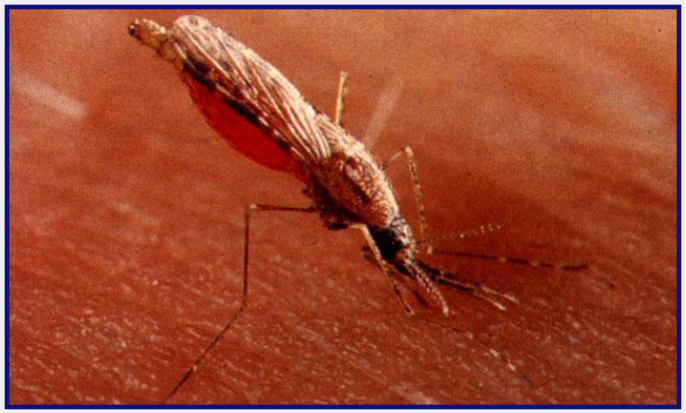
Cause of Malaria

- Cause – protozoan parasite genus *Plasmodium*
- Vector – female *Anopheles* mosquito (about 60 of the 400 species)
- Host - man
- Species of malaria parasite -
  - *P. falciparum*
  - *P.vivax*
  - *P. ovale*
  - *P. malariae*

Transmission

- Vector – *Anopheles* mosquito
- Blood transfusion
- Organ transplant
- Congenital





Malaria Risk

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- Risk varies widely between and within countries
- Depends on travel itinerary (location, duration, type of travel)
- Transmission is highest in Africa
- Most urban areas are malaria-free except in Africa and India
- Risk highest at end of rainy season
- Usually restricted to altitudes below 1500 meters but can occur up to almost 3000 meters

Locations of *P. falciparum* Drug Resistance

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- Resistance to Chloroquine has been confirmed in all areas with *P. falciparum* malaria except
  - Dominican Republic
  - Haiti
  - Central America west of former Panama Canal Zone
  - Egypt
  - Some countries in the Middle East

Locations of *P. falciparum* Drug Resistance (cont.)

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- ★ Resistance to Fansidar
  - Widespread in Amazon River Basin area of South America
  - Much of Southeast Asia
  - Other parts of Asia
  - Large parts of Africa
- ★ Resistant to Mefloquine
  - Borders of Thailand with Myanmar (formerly Burma) and Cambodia
  - Western provinces of Cambodia
  - Eastern states of Myanmar

Locations of *P. vivax* Drug Resistance

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- ★ Resistance to Chloroquine
  - Indonesia
  - Papua New Guinea
- ★ Declining sensitivity to Chloroquine
  - Brazil
  - Columbia
  - India
  - Myanmar (formerly Burma)
  - Republic of Korea
  - Thailand

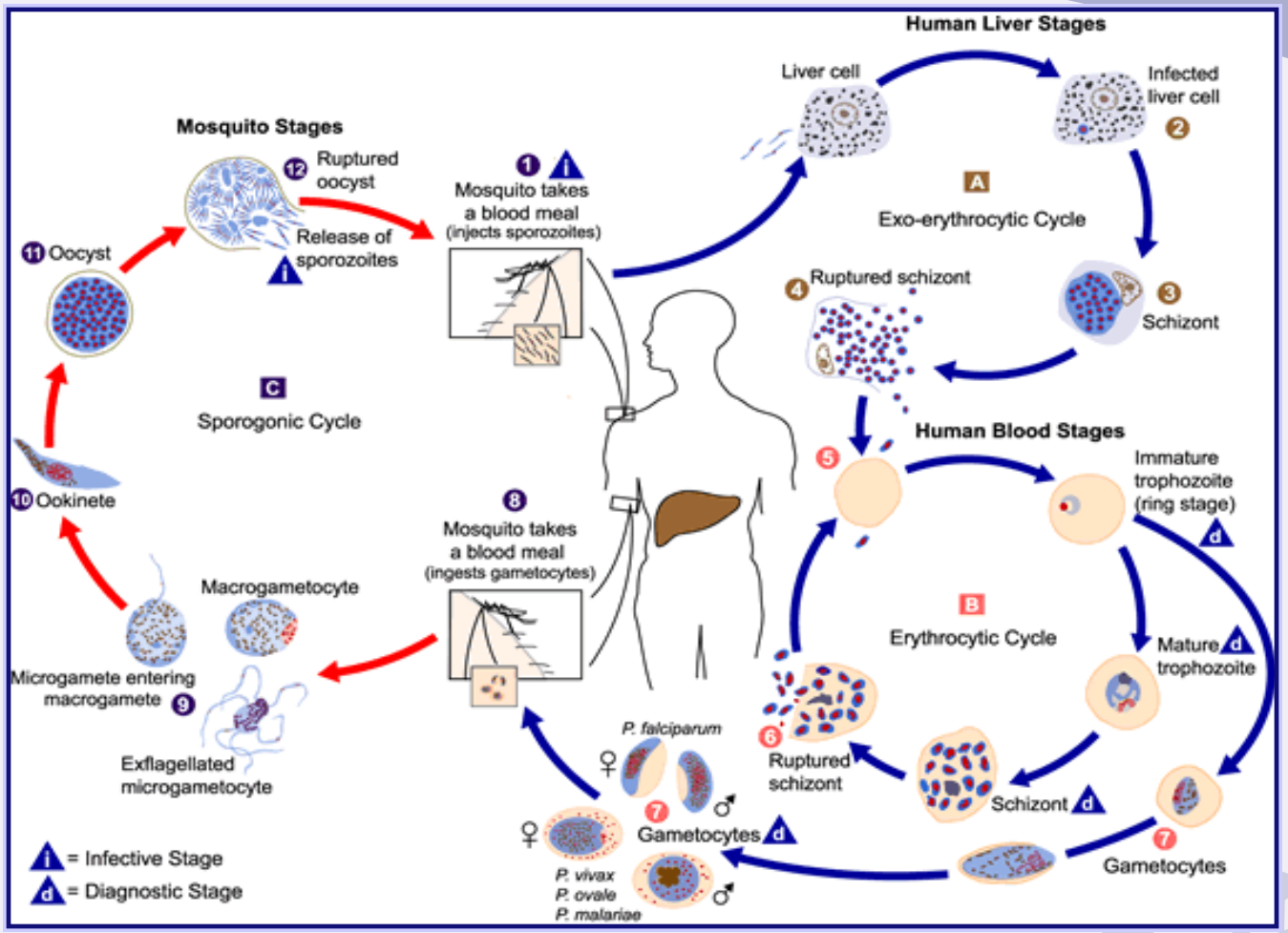
Locations of *P. malariae* Drug Resistance

- ★ Resistance to Chloroquine
  - Indonesia

Three Stages of Malaria Parasite Life Cycle

- Liver
- Red blood cells
- Mosquito

Life Cycle of Malaria Parasite



Centers for Disease Control and Prevention Division of Parasitic Diseases

Malaria Incubation Period

- Corresponds with liver stage of malaria parasite
  - *P. falciparum* 12 Days
  - *P. vivax* 14 Days*
  - *P. ovale* 14 Days*
  - *P. malariae* 30 Days

* May be 8 - 10 months or longer for some strains

Life Cycle of Malaria Parasite (cont.)

- Infected mosquito takes blood meal and injects sporozoites into human host
- Sporozoites infect liver cells, multiply and mature into schizonts that rupture and release merozoites into the bloodstream
- In *P. vivax* and *P. ovale*, a dormant stage (hypnozoites) can persist in the liver and cause relapses by invading the bloodstream weeks, or even years, later
- Merozoites infect red blood cells

Malaria Parasite in Red Blood Cells

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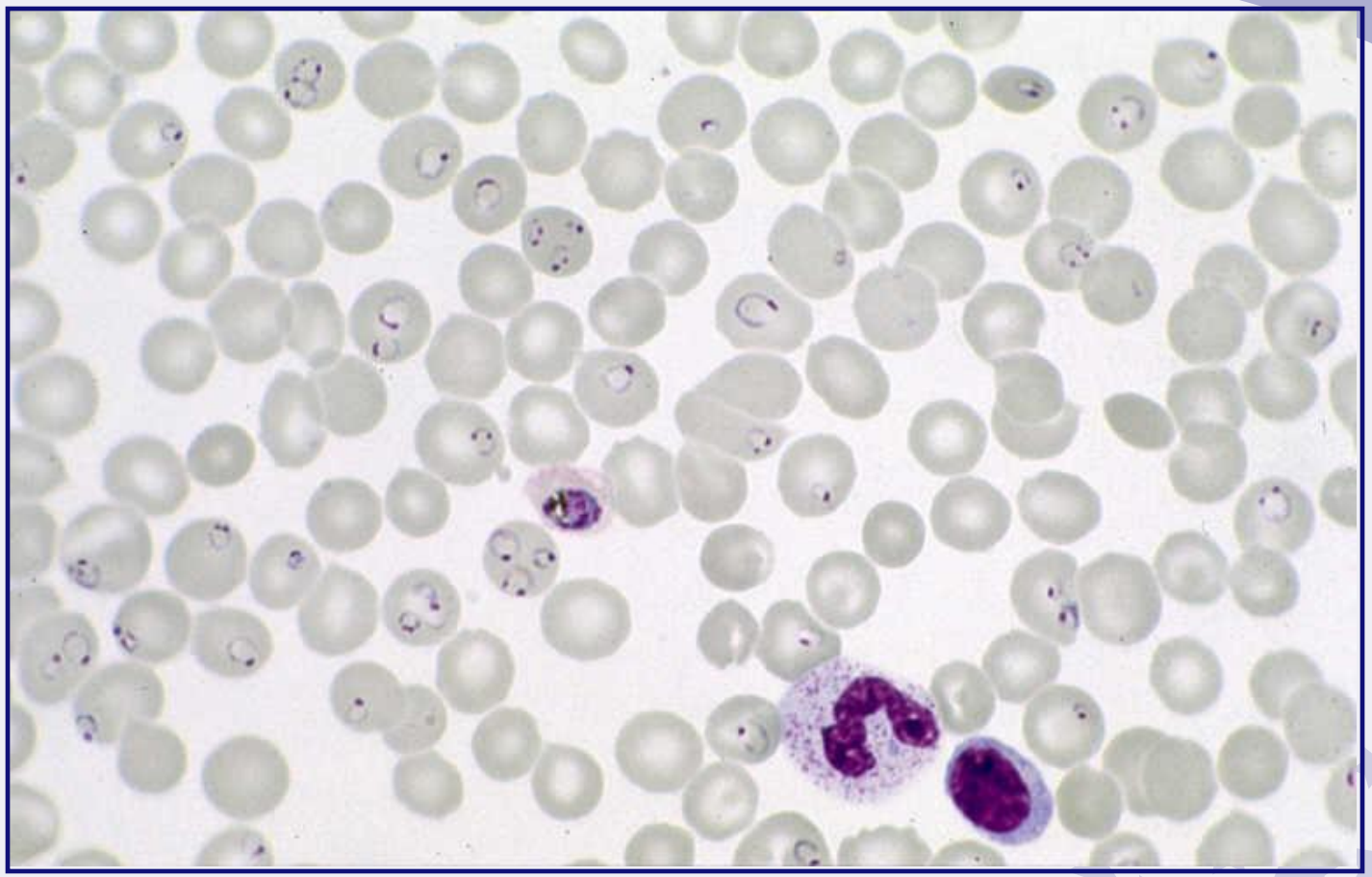

Classic Clinical Symptoms of Malaria

- Blood stage parasites are responsible for clinical manifestations
- Classical cyclic paroxysms
  - Cold stage: chills and shaking
  - Hot stage: warm, headache, vomiting
  - Sweating stage: weakness
- Feel well for period of time, then cycle repeats itself

Life Cycle of Malaria Parasite (cont.)

- Some merozoites mature into schizonts that rupture into the bloodstream releasing more merozoites
- Some merozoites differentiate into sexual cells (male and female gametocytes)
- Mosquito ingests gametocytes during blood meal
- Gametocytes mature and produce a fertilized egg that grows, ruptures and releases sporozoites
- Sporozoites migrate to mosquito's salivary gland waiting to be injected into a new human.

Principles of Malaria Protection

- Be **A**ware of the risk, the incubation period, and the main symptoms
- Avoid **B**eing bitten by mosquitoes, especially between dusk and dawn
- Take the (**C**hemoprophylaxis) antimalarial drugs to suppress infection when appropriate
- Seek immediate **D**iagnosis and treatment if a fever develops one week or more after entering an area where there is a malaria risk, and up to 1 year after departure

Personal Protective Measures (PPM)

- Avoid malarious areas
- Stay indoors from dusk to dawn in screened or air conditioned rooms
- Use insect spray inside rooms, bed nets
- Cover skin by wearing long sleeves, long pants
- Apply DEET lotion on exposed skin
- Use treated bed nets

DoD Insect Repellent System

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Permethrin On Uniform

+

DEET On Exposed Skin

+

Properly Worn Uniform

=

MAXIMUM PROTECTION

YOU NEED TO KNOW…

Dry cleaning removes permethrin from the uniform

US Army Center for Health Promotion and Preventive Medicine

Insect Repellents For Skin And Clothing

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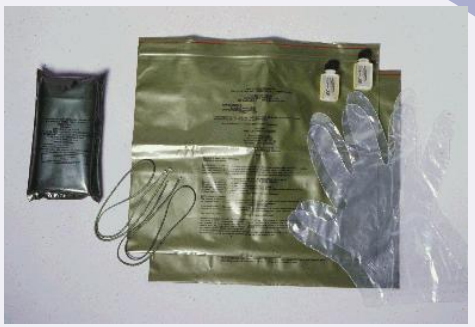
DEET lotion

NSN 6840-01-284-3982

- Apply a thin coat to EXPOSED skin
- One application lasts up to 12 hours

Permethrin

- Individual Dynamic Absorption Kit (IDA)
- Treatment lasts for for over 50 launderings



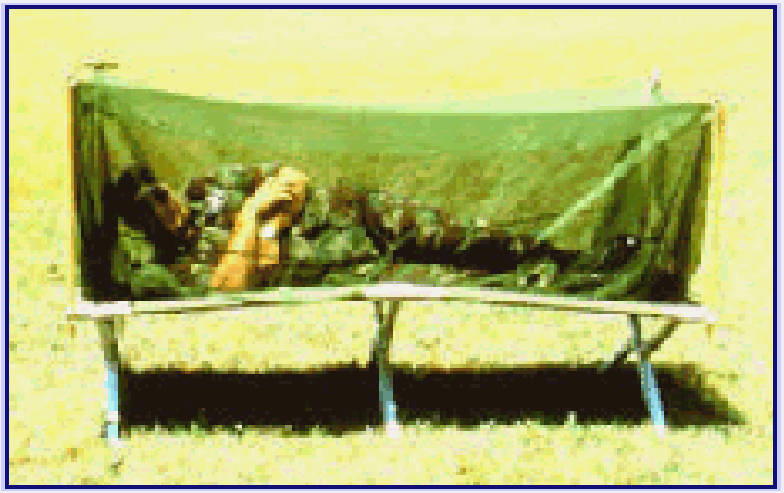
NSN 6840-01-345-0237

NSN 6840-01-278-1336

- Aerosol spray can
- Treatment lasts through 5-6 washes

Use of Bed Net While Sleeping

- Spray the outside of the net with permethrin
- Tuck edges under cot or sleeping bag
- Don’t let net touch your skin while you sleep



US Army Center for Health Promotion and Preventive Medicine

Chemoprophylaxis

- Broad term comprising multiple strategies for the prevention of disease using medications
- Primary prophylaxis
  - Prior to, during, and after the exposure period to prevent the initial infection
- Terminal prophylaxis
  - At the end of the exposure period (or immediately after) to prevent relapses or delayed-onset of clinical presentations

Action of Antimalarial Drugs

- Kills parasites during multiplication phase in red blood cells
- Suppresses symptoms by lowering the number of parasites in the blood; does not prevent infection
- Taken long enough, eventually eliminates *P. falciparum* and *P. malariae* infection
- Requires terminal prophylaxis to eliminate liver stage of *P. vivax* and *P. ovale*

Factors for Choosing Malaria Chemoprophylaxis

- Type of malaria
- Drug resistance in specific locations
- History of allergic or other reaction to the anti-malarial drug of choice
- Restriction based on job (e.g., mefloquine not authorized for aviators and divers)

Drugs for Primary Malaria Chemoprophylaxis

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- Chloroquine
- Mefloquine (Lariam® and generic brands)
- Doxycycline
- Atovaquone-proguanil (Malarone®)

Schedule for Taking Primary Malaria Chemoprophylaxis

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- ★ Prior to travel, start malaria medication:
  - Chloroquine and mefloquine - 1 to 2 weeks
  - Doxycycline and atovaquone/proguanil - 1 to 2 days
  - Can start earlier to allow any potential adverse effects to be identified prior to travel
- ★ Most antimalarial drugs well tolerated (Minor side effects do not require stopping the drug)
- ★ Continue drug during travel and after leaving malarious area:
  - Chloroquine, mefloquine and doxycycline - 4 weeks
  - Atovaquone/proguanil - 7 days

Antimalarial Medications

- Chloroquine
- Mefloquine (Lariam® and generic brands)
- Doxycycline
- Atovaquone-proguanil (Malarone®)
- Primaquine

Chloroquine

- Adults: 500 mg per week (300 mg base)
- From 1-2 weeks before entry, during, and 4 weeks after exit from malarious area
- OK in all ages, including infants, pregnant and lactating women
- Overdose in children potentially fatal
- Side effects: GI upset, headache, dizziness, blurred vision, insomnia and pruritis
- Has been reported to exacerbate psoriasis
- Occasional GI upset, recommend take with food

Drugs of Choice in Chloroquine-Resistant Areas

- Mefloquine (Lariam ®)
- Doxycycline
- Atovaquone-proguanil (Malarone®)

Mefloquine (Lariam ®)

- Adults: 250mg per week
- From 1-2 weeks before entry, during, and 4 weeks after exit from malarious area
- Safe for use in 2nd and 3rd trimesters and inadvertent use in 1st trimester has not resulted in adverse effects
- Safe for use in breastfeeding women, but infants must take their own separate dose of mefloquine

Mefloquine Contraindications

- Known hypersensitivity to mefloquine or related compounds (e.g., quinine or quinidine)
- Active depression or recent history of depression
- Generalized anxiety disorder, psychosis, schizophrenia, or other major psychiatric disorders
- History of seizure disorder or epilepsy

Mefloquine Cautionary Warnings

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- May cause psychiatric symptoms at rate of 1 per 2,000-13,000 persons
- Symptoms include: anxiety, paranoia, depression, hallucinations, psychotic behavior
- Rarely symptoms continue after drug is stopped
- Rare cases of suicidal ideation and suicide although no relationship has been confirmed
- Advise patients to discontinue medication if experience psychiatric symptoms such as excessive anxiety, depression, restlessness or confusion
- Substitute alternative antimalarial medication

Lariam Medication Guide

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- Developed by the Food and Drug Administration (FDA) in cooperation with the drug's manufacturer, Roche Pharmaceuticals
- Designed to help ensure patients understand the risks of malaria, and the rare but potentially serious psychiatric adverse events associated with use of Lariam
- As of July 2003, required that a Guide be given to the traveler each time that Lariam is dispensed
- Copy available at http://www.fda.gov/medwatch/SAFETY/2003/LariamMedGuide.pdf

Doxycycline

- Adults: 100 mg per day
- From 1-2 days before entry, during, and 4 weeks after exit from malarious area
- GI upset, photosensitivity, vaginal yeast infections, esophageal ulceration possible
- Take with sufficient liquid to transport capsule into stomach; take with food
- Contraindicated in pregnancy, lactation, and in children 8 and under
- Effectiveness equivalent to mefloquine and chloroquine

Atovaquone-proguanil (Malarone®)

- Adults: 1 tablet per day (atovaquone 250mg, proguanil 100mg)
- From 1-2 days before entry, during, and for 7 days after exit from malarious area
- Take with food or milky drink
- Adverse effects: abdominal pain, nausea, vomiting, headache
- Contraindicated in children <11kg, pregnant women, women breastfeeding infants <11kg, and patients with severe renal impairment

Pregnancy and Malaria

- ★ Malaria infection more severe
- ★ Increased risk for prematurity, abortion, stillbirth
- ★ Advise women who are pregnant or likely to become pregnant to avoid travel to malarious areas if possible
- ★ Chemoprophylaxis
  - Chloroquine is safe
  - Mefloquine is safe in 2nd and 3rd trimester and probably during the 1st
  - Don’t use primaquine, doxycycline, and atovaquone/proguanil

Terminal Prophylaxis with Primaquine

- Decreases the risk of relapses by eradicating liver stage of *P. vivax* and *P. ovale*
- Taken for 14 days during last 2 weeks of 4 week post-exposure prophylaxis with chloroquine, mefloquine or doxycycline
- Taken during the final 7 days of post-exposure prophylaxis with atovaquone/proguanil and for an additional 7 days or for 14 days after atovaquone/proguanil has been completed
- Adults: CDC has recently increased the recommended dose from 15mg to 30 mg

Terminal Prophylaxis with Primaquine (cont.)

- ★ Possible GI distress; take with food
- ★ Contraindicated in pregnancy
- ★ Breastfeeding OK if infant G6PD negative
- ★ G6PD deficiency and primaquine
  - Inherited sex linked trait, full expression in males
  - More common in persons of African, Mediterranean and Asian ancestry
  - Primaquine causes hemolysis, more severe in Mediterranean and Canton variants
  - G6PD testing advisable before treatment with primaquine

Restrictions on Blood Donation

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- Persons who are residents of nonmalarious countries are not allowed to donate blood for 1 year after returning from a malarious area
- Persons who are residents of malarious countries are not allowed to donate blood for 3 years after leaving a malarious area (Residence is > 6 months in country)
- Persons who have had malaria are not allowed to donate blood for 3 years after completion of treatment for malaria

Information Sources
Centers for Disease Control and Prevention

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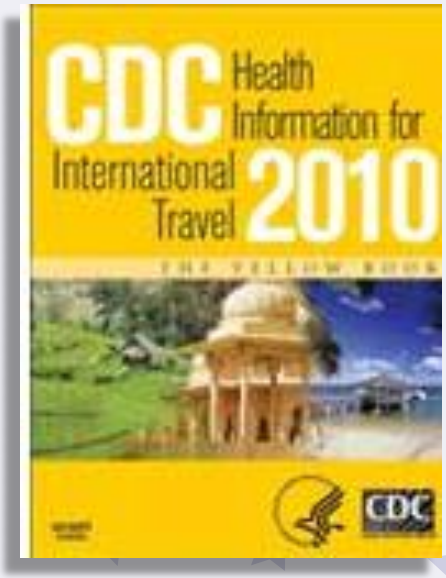
- ★ Health Information for International Travel
  - Recommendations on vaccines, medications, and other measures necessary to prevent illness and injury during international travel
  - http://wwwnc.cdc.gov/travel/default.aspx
- ★ Malaria Information
  - Guidelines for diagnosis, treatment, and prevention
  - http://www.cdc.gov/malaria



Information Sources (cont.)

Other Sources

- ★ World Health Organization
  - http://www.who.int/topics/malaria/en
- ★ Navy and Marine Corps Public Health Center
  - Malaria policies, publications and related information
    - Navy Medical Department Pocket Guide to Malaria Prevention and Control, NEHC-TM PM6250.1
  - http://www-nehc.med.navy.mil/Diseases_Conditions/malaria.aspx

Information Sources (cont.)

Other Sources (cont.)

- US Army Public Health Center
  - http://phc.amedd.army.mil
- National Center for Medical Intelligence
  - Malaria locations
  - https://www.intelink.gov/ncmi/index.php

Information Sources (cont.)

Deployment Health Clinical Center

www.PDHealth.mil

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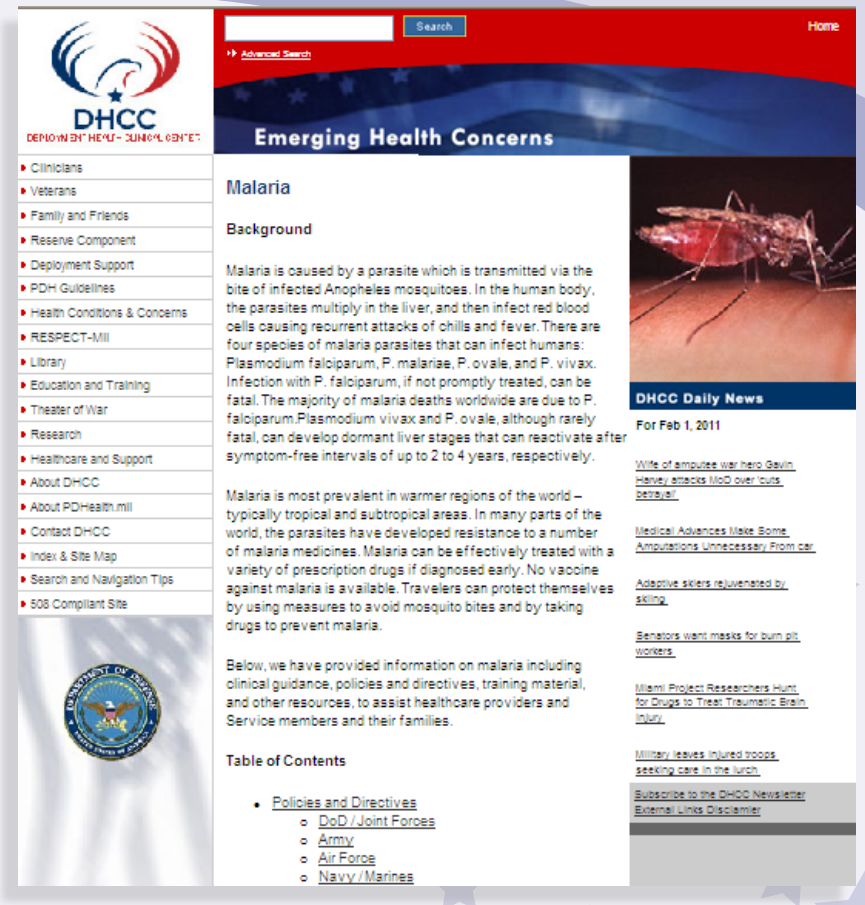
- ★ Audience
  - Clinicians, service members, veterans and families
- ★ Content Areas
  - Deployment support
  - Deployment-related clinical practice guidelines
  - Health conditions and concerns
    - Malaria
  - Healthcare and support services
  - Education and training
  - Risk communication
  - Deployment-related research
  - News and forms library
- ★ Types of Material
  - Policies and directives
  - Clinical guidance
  - Provider/patient education material
  - Relevant research and news
  - Forms and measures
  - Related links



Questions, Information, Assistance

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202-782-6563
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Provider Helpline
1-866-559-1627

Patient Helpline
1-800-796-9699